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CONTENTS:

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SEVENTH SUMMER MEETING OF THE GEOLOGICAL SOCIETY OF AMERICA.

THE seventh summer meeting of the Geological Society of America convened in Springfield, Mass., August 27th and 28th, 1895. The Council assembled the evening before, prepared the program of the meeting and formulated such other business as was necessary to present to the Society the following day. The fellows and and their friends to the number of thirty-five assembled in the new City Art Museum at 10 A. M., August 27th. The meeting was called to order by President Shaler, who introduced Dr. William Rice, Secretary of the Library Association of Springfield. Dr. Rice welcomed the Society in a few happily chosen remarks, from which the Society learned that they were the first organization to occupy the building. President Shaler replied to the address. Brief memorial mention was made of Professor Henry B. Nason, of Troy, and Professor James D. Dana, of New Haven, the two fellows who had passed away since the last meeting. Extended memorials were, however, postponed to the winter meeting, according to the usual custom. The Secretary announced the election of the following fellows: S. P. Baldwin, Cleveland; O. C. Farrington, Chicago; G. P. Grimsley, Topeka, Kansas; F. P. Gulliver, Norwich, Connecticut; J. B. Hatcher, Princeton, New Jersey; E. B. Matthews, Baltimore; J. C. Merriam, Berkeley, California; H. B. C. Nitze, Baltimore; F. L. Ransome, Berkeley, California; Charles Schuchert, Washington, D. C.; J. A. Taff, Washington, D. C. The report of the committee on the preparation of a card catalogue of scientific literature, which was printed in the

proceedings of the Baltimore meeting, but which had been laid on the table pending amendment, was recalled and passed unanimously. The committee (Emmons and Willis), appointed at the Madison meeting, 1893, to urge on the United States Senate the importance of making the region about Mt. Rainier a public park, reported that they and others had presented the case to the Senate Committee having it in charge, but that the bill had failed of recommendation. On motion the committee was continued, and President Shaler was added to it. Before proceeding to the reading of papers the usual rule was adopted, that papers not presented by their authors in person should go to the end of the list. The first paper read was 'The Champlain Glacial Epoch,' by C. H. Hitchcock, Hanover, N. H. The author stated that when he gave the name Champlain to the clays and sands along this lake, he was a disciple of Lyell, and believed in submergence and iceberg action, but wider experience had made him a follower of Agassiz, and in that he now favored a moderate submergence with local glaciers coming down from the mountains to the east and west, but with an oceanic connection, certainly out through the Gulf of St. Lawrence and probably to the Hudson and westward. He mentioned the species of shells found in the clays of the St. Lawrence Valley, and along the Atlantic near Portland, Maine, and proved them to be of a Labradorian facies. On citing the European divisions of the Glacial Age of James Geikie, the speaker surmised that the Champlain epoch corresponded to the Mecklenbergian.

The paper led to a somewhat extended discussion. I. C. White raised the question of the connection between the submergence and the terraces of the river valleys in the Alleghenies in West Virginia and Pennsylvania, and the lack of fossils. J. F. Kemp cited the barrenness of the clays in the Hudson Valley in all organic remains except a few diatoms, and that the variety was small in the Champlain valley itself. J. W. Spencer remarked the moderate elevation of the Laurentide Mountains so-called and other topographical features of the St. Lawrence Valley. W. M. Davis brought up the importance of properly distinguishing terraces in work of this kind, especially as between marine and re-cut river deposits in valleys. The discussion then drifted to the meaning of Champlain, as to whether it applied to a time division or a series of sediments, and was closed by the president, who suggested that the lack of fossils might be caused by the decay of organic matter in the clays, which would develop gases and destroy them.

The second paper was by H. L. Fairchild, of Rochester, N. Y., and was entitled 'The Glacial Genesee Lakes.' By means of an admirable map, the valley of the Genesee River was shown and the relations of its drainage basin to surrounding river systems. The heights of the divides were marked from the headwaters in Pennsylvania down to Rochester. The argument was then made that the ice-sheet came from the north and filled the valley, all of whose streams were pre-glacial and had flowed in almost all cases near their present channels. Then as the ice retreated the waters at its front and from neighboring heights were ponded back and were drained off to the south, west and east, sometimes to the Allegheny River system, sometimes to the Susquehanna. The old channels are now largely represented by cols with swamps at the divides. Ten stages were recognized in all, viz.: 1. The headwater cols over 2,000 ft. A. T. south of Genesee, Pa. 2. The col at the head of the west branch near Genesee, Pa. 3. At Mapes, N. Y., col, 1606 A. T. 4. Head of Olean Creek, col 1490. 5. The cut from Portage to the headwaters of the Susquehanna. 6. Col at Hor-

nellsville, 1200 A. T. 7. A broad stream to westward over flat country north of Portage. 8. Warren Water. 9. Lake Iroquois. 10. Present relations. The speaker also described the terraces, bisected deltas and other surface deposits that corresponded to the several cols, and remarked that there were but four places where the present streams were working on rock.

I. C. White asked if the old burned channels around these rock cuts were known, but the speaker replied that there was too much drift and too few borings. President Shaler argued that the cols of the first stage were due to subglacial streams. J. W. Spencer, W. M. Davis and H. S. Williams brought up minor points, after which adjournment was made for lunch.

The Society met at 2 and listened to an extended paper by Professor B. K. Emerson, of Amherst, on 'The Geology of Hampshire, Hampden and Franklin Counties, Mass.' These are the three counties along the Connecticut river in Massachusetts. They embrace Archean crystalline rocks, metamorphosed Cambrian and Devonian sediments, Triassic sandstones and traps, Glacial deposits and Champlain clays. The speaker illustrated his remarks by large maps, the results of nearly twenty-five years of study. His address was divided into three heads. He first took up the Archean and paleozoic rocks. The former are in the continuation of the Green Mountains and lie on the west side of the valley. Among other things they embrace a great belt of granite containing inclusions of marble, and a great belt of hornblende schist on which rests the emery bed at Chester. On the older crystallines lies unconformably the Cambrian conglomerate now metamorphosed to gneiss, and the same appears at Monson on the east, where it is quarried as granite. The Devonian beds appear at Bernardston and exhibit remarkable contact metamorphism. The second part of the paper dealt with the Triassic sandstones and traps. The dikes, plugs, tuffs, and the faults characteristic of this series were described. The third part of the paper discussed the glacial deposits, Champlain clays and the variations in the channel of the Connecticut river in the formation of oxbows.

The address was the most important of the meeting and was listened to with close attention by all present.

The next paper was by W. B. Clark, of Baltimore, 'On the Eocene Fauna of the Middle Atlantic Slope.' The speaker reviewed our previous knowledge of the forms of life of this period and detailed the great increase in the number of species and in the sharpness of their determination that had resulted from the explorations of the last few years. The faunas were now so well understood and established as to be of great stratigraphic value. The paper was followed by R. T. Jackson and T. A. Jaggar, of Cambridge, Mass., on the 'Arrangement and Development of Plates in the Melonitidæ.' The anatomical structure and life history of this group of echinoderms were described. The next paper was by Wm. H. Hobbs, Madison, Wis., 'Pre-Cambrian Volcanoes in Southern Wisconsin.' The speaker presented a preliminary report on the study of a group of isolated areas of igneous rocks which protrude through the Potsdam sandstone in the valley of the Fox river, Wisconsin. Some of these areas represent local outflows of rhyolitic lava which exhibits superb examples of spherulitic, perlitic, fluxion and breccia structures. The originally glassy ground mass of these rocks has become devitrified; hence they are apo-rhyolites, and they have been subjected to dynamic metamorphism and subsequent infiltration of silica. They are intruded by dikes of both basic and acid rocks. Specimens and photographs of sections were exhibited.

The succeeding speaker was A. Capen Gill, of Ithaca, N. Y., on 'A Geological Sketch of the Sierra Tlayacac, in the State of Morelos, Mexico. The Sierra Tlayacac, situated to the southward of the great fault-line described by Felix and Lenk, consists of a projecting group of mountain tops in the midst of the Morelos Plain. The plain is formed by the lava streams and ejectamenta of Popocatepetl or neighboring volcanic vents. The tops of the nearly submerged mountains show that the folding and elevation of the Cretaceous (Caprina?) limestone was accompanied or followed by the deposition of a limestone conglomerate, in the pebbles of which are also Caprina (?) fossils. Lack of eruptive pebbles indicates that the volcanic activity of the region was subsequent to extensive folding and erosion.

The limestone conglomerate is overlain by an acid eruptive, and both rocks are cut by numerous dykes which show a close 'consanguinity' with the recent extrusions of Popocateptl. The very striking metaphorphism produced by these dykes corroborates the view that there is little, if any, migration of material from the intruded mass into the metamorphosed rock.

Heated water and steam would appear to be the principal agents of metamorphism, rather than heat alone, since the great distance to which recrystallization has reached seems dependent on the *porous character* of the rock before alteration.

Garnet, vesuvianite, wollastonite and pyroxene are among the minerals developed, and large crystals have been found at a distance of several hundred feet from the contact.

Considerable discussion followed in which the forbearance of the author in refraining from the creation of new rock-names, was heartily commended.

The session then adjourned until 9 A. M. of Wednesday. On reassembling the following morning the first paper was presented by W. M. Davis, Cambridge, Mass., on 'The Bearing of Physiography on Uniformitarianism.'

The conditions and processes postulated in the physiographic study of land forms—geomorphology of some authors—are among the cardinal principles of uniformitarianism. The success in the interpretation of nature by means of this kind of study confirms the correctness of its postulates, and thus brings to the support of uniformitarianism a large class of facts, whose bearing on this theory was not at all perceived when its early advocates announced it. These general principles were further elucidated by the example of the development of the river Marne in northeastern France, and of its associated streams. The migration of divides and the robbing of one stream by another in the course of slow degradation were traced out as an illustration of large effects from the operation of slow and gradual causes. In discussion B. K. Emerson cited similar cases of the robbing of one stream's headwaters by another, in the relations of the Housatonic and Connecticut divides in western Massachusetts. President Shaler emphasized the importance of continental tilling in bringing about these changes of drainage, and illustrated his point by cases in the Berkshire Hills.

C. R. Van Hise, of Madison, Wis., followed with a paper on the 'Analysis of Folds.' As regards movement three zones in the constitution of the earth were cited, an outer of fracture, an inner of fracture and flowage, and an interior one of flowage alone. The particular depth or extent of each depends on the hardness or softness of the strata; shales, for instance, flow at a small depth. The subject of folds was then taken up, and it was shown that the ordinary treatment of the subject with sections in only two dimensions was incomplete in that it failed to properly emphasize the pitch of the axes and the presence of other

folds at angles with the first series. The relations of various smaller wanes as all parts of one great one were also brought out, and especially the association of minor overthrown anticlines with a central fan-shaped fold. The former incline toward the latter in case of fan-shaped synclines and away from it in corresponding anticlines. The paper closed with practical suggestions in taking and interpreting observations, but feeling pressed for time, the speaker passed over them with such rapidity that an appreciation of them will require the printed text. W. M. Davis in discussion referred to the three zones originally cited and asked if the speaker could estimate from the character of the flowing or fracture, shown by an eroded fold, anything about the original burden of rock that had been removed. Prof. Van Hise in reply stated that he thought it could be done within reasonably wide limits, say two to five thousand feet.

The following paper was by N. S. Shaler, of Cambridge, Mass., and was entitled 'On the Effects of the Expulsion of Gases from the Interior of the Earth.' The smaller cases of gases emerging from muddy river bottoms, lakes and swamps were first treated, and then the larger manifestations of the same at times of earthquakes, such as those at New Madrid and Charleston. The action was likened to the succession of bubbles in champagne or soda water. One getting started eases up the weight of the overlying column of water, so that many others follow in the same path. The lack of fossils or organic remains in mud and clay where they must have originally been abundant was explained by the dissolving action of these gases, especially while in solution. The explosion of vapors in volcanic conduits was then taken up, illustrated by the speaker's observations on Vesuvius and explained in the same way as the simpler cases.

Arthur Hollick, of New York, next presented a paper on 'Cretaceous Plants from Martha's Vineyard.' Results were obtained from an examination of the material collected by David White in 1889.

At the New York meeting of the Society in December, 1889, Mr. David White read a paper entitled 'Cretaceous Plants from Martha's Vineyard,' which was published in abstract in the proceedings of that meeting. The author subsequently published a more extended account in the *American Journal of Science* for February, 1890, and figured a few of the specimens which were most readily to be identified as cretaceous species. These papers were based upon material collected by the author and Mr. Lester F. Ward during the summer of 1889. The object of these papers was principally to demonstrate the occurrence of cretaceous strata in that island, hence only sufficient material for that purpose was utilized. During the present year all the material which was collected was turned over to him for examination and report, in addition to which there were a few specimens collected personally during the summer of 1893. The general results obtained indicated a flora parallel with that of the Amboy clays of New Jersey, but as the fossil leaves are found in concretionary sandstones which are mixed with the clays in somewhat uncertain relations, it is very desirable to obtain, if possible, remains in the clays themselves. The difficulty in preserving such as have hitherto been noted has prevented their study.

J. F. Kemp, of New York, then read a contribution on 'The Titaniferous Iron Ores of the Adirondacks.' The paper opened with a brief statement of the characters of the two kinds of iron ores which are afforded by the region, the merchantable magnetites and the titaniferous. The former are in gneisses; the latter in the gabbros and anorthosites of the Norian, which are believed to be intruded through the gneisses.

A list of localities of the titaniferous ores was given and the distinction was made between the smaller bodies which are, so far as can be seen, basic developments of gabbro, and the enormous ore bodies at the old Adirondack Iron Works, in the heart of the mountains. These latter are in massive anorthosite, which is almost entirely formed of large, blue-black crystals of labradorite. The ore bodies, and especially the one crossing Lake Sanford, contain numerous included labradorite crystals, each of which is surrounded by a reaction rim 5–10 mm. across. It was further shown that the wall rocks show no signs of the widespread crushing that is exhibited in the general 'mortar-structure' of the Adirondack and Canadian anorthosites, but are plutonic rocks free from evidences of dynamic metamorphism. The argument is then made that the ores are segregations from an igneous magma formed during the process of cooling and crystallization. In conclusion the speaker gave some notes on recent attempts to utilize these ores that bid fair to be successful.

In discussion, C. R. Van Hise mentioned the similar bodies of titaniferous ores in the gabbros of Lake Superior, adding, however, that there had been some infiltration of iron oxide since the formation.

The last paper of the meeting was presented by J. C. Branner, of Stanford University, California, on 'The Decomposition of Rocks in Brazil.'

The decomposition of rocks is much more profound in Brazil than in temperate regions. This decay has lately been demonstrated by railway cuts and tunnels and by deep mines, records of which was given. This decomposition is produced by mechanical and chemical agencies.

The chief mechanical agency is daily change of temperature suffered by rocks openly exposed to the sun—about 100 degrees Far. This causes exfoliation of mountain masses and of boulders and open crevices that admit water, air, insects, and these set up a train of reactions that soon destroy the rock. Chemical agencies are organic and inorganic. The inorganic agencies are carbonic and nitric acid brought down in rains in great quantities. The organic chemical agencies are insects and plants. The ground is then filled with vast hordes of ants whose breath and food form acids that attack the rocks. The rapid decay of a very rank vegetation contributes the chief agent of rock decomposition. Rain falling on hot rocks greatly increases the action of these agents. The paper was illustrated by sketches and photographs and excited the deepest interest.

On account of the absence of the authors and the need of adjournment in view of an excursion that was offered by Professor Emerson to Mt. Holyoke in the afternoon, the following papers were only read or announced by title:

George M. Dawson and R. G. McConnell: 'On the Glacial Deposits of Southwestern Alberta,' in the vicinity of the Rocky Mountains. Warren Upham: 'Drumlins and Marginal Moraines of Ice-sheets.' N. H. Darton: 'Notes on Relations of Lower Members of Coastal Plain Series in South Carolina.' N. H. Darton: 'Resumé of General Stratigraphic Relations in the Atlantic Coastal Plain from New Jersey to South Carolina.' George P. Merrill: 'On Asbestos and Asbestiform Minerals.' C. A. Gordon: Syenite-Gneiss (Leopard Rock) from the Apatite Region of Ottawa County, Canada.

The regular meeting adjourned after passing a vote of thanks to the Library Association of Springfield, and to the Local Committee.

In the afternoon thirty-seven fellows accompanied Professor Emerson to Mt. Holyoke to see the contacts of trap and sandstone, the dikes, plugs, bird-track and other

phenomena of the Triassic. Before the meeting a more extended trip was taken by a good sized company. Professor Wm. H. Hobbs guided them through the interesting metamorphic region of the Berkshire Hills. They were met at Pittsfield by Professor Emerson, who took them to Chester, Bernardston, Turner's Falls, and other points of interest in the Connecticut Valley.

On the whole the meeting was an interesting and well attended one, but, as in previous summers, the fellows of the Geological Society to a very great extent returned to their homes on its conclusion. The meetings of Section E of the American Association are thereby crippled, and the question was raised in the minds of not a few, who have the interests of Section E likewise at heart, whether it is on the whole wise for the Geological Society to hold other than a business meeting, in the summer, for which there would always be a sufficient number of fellows on account of the meetings of the American Association. It is also a question whether it is wisest for the American Association to have for its meetings a week broken by Saturday and Sunday. The temptation for members to go to their homes on Saturday is well-nigh irresistible and comparatively few return. As a result the final sessions have few attendants and the available candidates for sectional officers who are actually present on the day of election are few. A session beginning Tuesday and closing Saturday would have many advantages.

J. F. KEMP.

COLUMBIA COLLEGE.

*THE RELATIONS OF THE INDUSTRIES TO THE ADVANCEMENT OF CHEMICAL SCIENCE.**

WE justly congratulate ourselves that development and progress in chemistry, both in science and technology, have been more rapid in the past three decades than ever before, and that as much has been accomplished in this period as in all the years preceding since reactions have been known and applied. New elements, new compounds, new theories and new laws have followed each other in the manifold directions with such enormous rapidity that few have been able to keep informed of all, and most of us of only a few, of the discoveries and generalizations that have been made. It is for the purpose of exchanging information on these subjects that we come together at the present time, and it has been the custom of the Chairman to discuss one or another of these lines of progress, setting forth the most important of what has been developed in the more recent times. In many of the discussions and addresses on similar occasions by those more or less closely allied with or engaged in the study of so-called pure chemistry, much has been said of the practical value of the results obtained in the scientific laboratories devoted to research, and the uses they have found in daily life. No one has arisen to question the truth of what has been said, nor could it be questioned, for the men who have been working with the most unselfish devotion to the pursuit of truth for truth's sake, and with little hope of reward for the service they have rendered, have acquired and disseminated a store of knowledge which has added so largely to the capacity of all men for work that only the most grateful acknowledgments may be offered. While all this may be accepted, it is seldom that anything is heard regarding the reciprocal influence of the industries and the ordinary occupations of daily life upon the development or advancement of chemical science, and it has seemed that, in this period of relaxation, it would be well to stop and consider what are the relations of the industries to the science from the other

* An address before the American Association for the Advancement of Science, August 29, 1895, by the Vice-President, Section C.